CLAIMS

I claim:

1. A D-peptide comprising a sequence of from three to seven D-amino acid residues, wherein at least two of the amino acid residues of the sequence are independently selected from the group consisting of D-tryptophan, D-tyrosine, and D-phenylalanine.

2. The D-peptide of claim 1, wherein the sequence comprises at least three amino acid residues independently selected from the group consisting of D-tryptophan, D-tyrosine, and D-phenylalanine.

3. A D-peptide comprising a pentapeptide sequence selected from the group consisting of Xaa_1YYFF, Xaa_1FYFF, Xaa_1YFFF, Xaa_1FFYF, Xaa_1YFFY, Xaa_1YFYF, Xaa_1FFFF, Xaa_1FYYF, $FXaa_1FFF$, $YFXaa_1FF$, Xaa_1FWXaa_2Y, Xaa_1FXaa_2WY, Xaa_1Xaa_2FFW, Xaa_1FFFY, $FFFFXaa_1$, $YXaa_1YFF$, $YXaa_1FFY$, Xaa_1FF Xaa_2Xaa_3, Xaa_1WYFF, Xaa_1F Xaa_2FF, Xaa_1Y Xaa_2FF, $Xaa_1FFYXaa_2$, Xaa_1FFXaa_2F, $Xaa_1Xaa_2Xaa_3YY$, $Xaa_1Xaa_2Xaa_3FF$, Xaa_1FYWF, Xaa_1Xaa_2FYY, Xaa_1YYFY, Xaa_1FYXaa_2Y, $WXaa_1FFF$, $Xaa_1FFFXaa_2$, Xaa_1YYYY, $FXaa_1WFF$, $WXaa_1FWXaa_2$, $WFXaa_1FXaa_2$, $FWXaa_1FF$, $FXaa_1FFY$, $Xaa_1Xaa_2WXaa_3Y$, $FFWXaa_1Y$, $FXaa_1Wxaa_2Xaa_3$, $YYXaa_1YY$, $FFFXaa_1F$, $YFYFXaa_1$, $YWXaa1FF$, $WXaa_1Yxaa_2F$, $WXaa_1YFXaa_2$, $WXaa_1FFXaa_2$, $FFFXaa_1W$, $FWFXaa_1Xaa_2$, $FYXaa_1YF$, $FWXaa_1Xaa_2Xaa_3$, $FXaa_1YYW$, $FXaa_1YYXaa_2$, $FWXaa_1WY$, $FFWYW$, $FXaa_1Xaa_2FXaa_3$, $FYWXaa_1Y$, $FYWXaa_1W$, $FXaa_1YFXaa_2$, $FWWYF$, $FYYYXaa_1$ and $FFXaa_1WW$ wherein Xaa_1, Xaa_2, and Xaa_3 are amino acids of the D- or L- configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M, and P.

4. The D-peptide of claim 3, wherein the core pentapeptide is selected from the group consisting of GYYFF, GFYFF, GYFFF, GFFYF, GYFFY, GYFYF, AFFFF, AFYYF, AFFYF, FAFFF, YFAFF, GFWGY, GFGWY, GAFFW, GFFFY, AFYFF, AFFFY, FFFFG, YAYFF, YAFFY, GFFGA, GWYFF, GFGFF, GYGFF, GFFYG, GFFGF, AAGYY, AAAFF, GFYWF, GGFYY, GYYFY, AFYAY, WAFFF, GFFFA, AYYYY, FAWFF, WAFWA, YGYYA, WFAFA, AFFFA, FWAFF, FAFFY, GAWAY, FFWGY, FAWGA, YYAYY, FFFAF, YFYFA, YWAFF, FFFGW, FWFGA, FYGYF, FWAAA, FAYYW,

FGYYG, FWAWY, FFWYW, FAAFG, FYWAY, FYWGW, FAYFG, FYYYA, FWGFF, and FFAWW.

5. A library comprising a plurality of D-peptides, wherein each D-peptide comprises from three to seven D-amino acid residues, wherein at least 25% of the D-peptides comprise at least three amino acid residues independently selected from the group consisting of D-tryptophan, D-tyrosine, and D-phenylalanine.

6. The library of claim 5, wherein at least 50% of the D-peptides comprise at least three amino acid residues independently selected from the group consisting of D-tryptophan, D-tyrosine, and D-phenylalanine.

7. A library according to claim 5, wherein the library comprises at least five D-peptides.

8. A library according to claim 5, wherein the library comprises at least ten D-peptides.

9. A library according to claim 5, wherein the library comprises at least fifty D-peptides.

10. A method for identifying a D-peptide having the ability to bind to a pre-selected protein comprising contacting the protein with a library of D-peptides according to claim 5, detecting binding of the protein to a D-peptide, and identifying the D-peptide.

11. A method for making a D-peptide that binds to a pre-selected protein, comprising contacting the library of claim 5 with the protein, detecting binding of the protein to a D-peptide, identifying the D-peptide, and synthesizing the D-peptide.

12. A method for reducing the toxicity of a toxin in a mammal exposed to the toxin comprising delivering to the mammal a D-peptide that binds to the toxin in an amount effective to reduce toxicity, wherein the D-peptide comprises from three to seven D-amino acid residues, wherein at least two of the D-amino residues are independently selected from the group consisting of D-phenylalanine, D-tryptophan, and D-tyrosine.

13. The method of claim 12, wherein the D-peptide is identified according to the method of claim 10.

14. The method of claim 12, wherein the toxin is selected from the group consisting of botulinum toxins, ricin toxins, cholera toxins, and anthrax toxins or toxin subcomponents.

15. The method of claim 12, wherein the toxin is BoNT/A and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa_1YFFF, Xaa_1FFYF, Xaa_1YFFY, Xaa_1YFYF, Xaa_1FFFF, Xaa_1FYYF, Xaa_1FFYF, FXaa_1FFF, YFXaa_1FF, wherein Xaa_1 is an amino acid of the D- or L-configuration selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M, and P.

16. The method of claim 15, wherein the toxin is BoNT/A and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GYFFF, GFFYF, GYFFY, GYFYF, AFFFF, AFYYF, AFFYF, FAFFF, and YFAFF.

17. The method of claim 12, wherein the toxin is BoNT/B and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa_1FWXaa_2Y, Xaa_1FXaa_2WY, Xaa_1Xaa_2FFW, Xaa_1FFFY, Xaa_1FYFF, Xaa_1FYFF, Xaa_1FFFY, FFFFXaa_1, YXaa_1YFF, and YXaa_1FFY, wherein Xaa_1 and Xaa_2 are amino acids of the D- or L-configuration selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M,.

18. The method of claim 17, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFWGY, GFGWY, GAFFW, GFFFY, GFYFF, AFYFF, AFFFY, FFFFG, YAYFF, and YAFFY.

19. The method of claim 12, wherein the toxin is BoNT/E and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa_1FF Xaa_2Xaa_3 and Xaa_1WYFF, wherein Xaa_1, Xaa_2, and Xaa_3 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, S, T, G, A, V, L, I, M, and P.

20. The method of claim 19, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFFGA and GWYFF.

21. The method of claim 12, wherein the toxin is BotB complex and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa_1FXaa_2FF, Xaa_1YXaa_2FF, Xaa_1FFYXaa_2, Xaa_1FFXaa_2F, $Xaa_1Xaa_2Xaa_3$YY, and $Xaa_1Xaa_2Xaa_3$FF

wherein Xaa_1, Xaa_2, and Xaa_3 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M, and P.

22. The method of claim 21, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFGFF, GYGFF, GFFYG, GFFGF, AAGYY, and AAAFF.

23. The method of claim 12, wherein the toxin is RCA60 and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa_1FYWF, Xaa_1Xaa_2FYY, Xaa_1YYFY, Xaa_1FYFF, Xaa_1YFFY, Xaa_1FYXaa_2Y, Xaa_1FYYF and WXaa_1FFF, wherein Xaa_1 and Xaa_2 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M, and P.

24. The method of claim 23, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFYWF, GGFYY, GYYFY, GYFFY, GYFFY, AFYAY, AFYYF and WAFFF.

25. The method of claim 12, wherein the toxin is RCA120 and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa_1FFFXaa_2 and Xaa_1YYYY, wherein Xaa_1 and Xaa_2 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, S, T, G, A, V, L, I, M, and P.

26. The method of claim 25, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFFFA and AYYYY.

27. The method of claim 12, wherein the toxin is cholera toxin and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of FXaa_1WFF and WXaa_1FW Xaa_2, wherein Xaa_1 and Xaa_2 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

28. The method of claim 27, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of FAWFF and WAFWA.

29. The method of claim 12, wherein the toxin is anthrax protective antigen and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of YGYYA and $WFXaa_1FXaa_2$ wherein Xaa_1 and Xaa_2 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

30. The method of claim 29, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of YGYYA and WFAFG.

31. A method of reducing the ConA lectin binding to at least one of its receptors comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of Xaa_1YYFF and Xaa_1FYFF wherein Xaa_1 is an amino acid of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

32. The method of claim 31, wherein each D-peptide comprises a pentapeptide core sequence selected from a group consisting of GYYFF and GFYFF.

33. A method of reducing binding of GS1-B4 lectin to a GS1-B4 receptor comprising delivering to the mammal a D-peptide comprising a pentapeptide core sequence selected from the group consisting of Xaa_1FYYF, $Xaa_1FFFXaa_2$, $FWXaa_1FF$ and $FXaa_1FFY$ wherein Xaa_1 and Xaa_2 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

34. The method of claim 33, wherein the D-peptide comprises a pentapeptide core sequence selected from a group consisting of AFYYF, AFFFA, FWAFF and FAFFY.

35. A method of reducing binding of an anti-αGal antibody to an αGal epitope comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of $Xaa_1Xaa_2WXaa_3Y$, $FFWXaa_1Y$ and $FXaa_1WXaa_2Xaa_3$ wherein Xaa_1, Xaa_2 and Xaa_3 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

36. The method of claim 35, wherein the D-peptide comprises a pentapeptide core sequence selected from the group GAWAY, FFWGY and FAWGA.

37. A method of reducing inhibiting anti-Ley/H antibody binding to an Ley/H epitope comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of $YYXaa_1YY$ wherein Xaa_1 is independently selected from a group consisitng of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P, the latter amino acids beinfg of D- or L-configuration.

38 The method of claim 37, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of YYAYY.

39. A method of reducing binding of TNFα to a TNFα receptor comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of $FFFXaa_1F$, $YFXaa_1FF$, $YFYFXaa_1$, $YWXaa_1FF$, $WXaa_1YXaa_2F$, $WXaa_1YFXaa_2$ and $WXaa_1FFXaa_2$ wherein Xaa_1 and Xaa_2 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

40. The method of claim 39, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of FFFAF, YFAFF, YFYFA, YWAFF, WGYAF, WGYFA and WAFFA.

41. A method of reducing the binding of TGFβ1 to a TNFβ1 receptor comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of $FFFXaa_1W$, $FWFXaa_1Xaa_2$, $FYXaa_1YF$, $FWXaa_1Xaa_2Xaa_3$, $FXaa_1YYW$, $FXaa_1YYXaa_2$, $FWXaa_1WY$, FFWYW, $FXaa_1Xaa_2FXaa_3$, $FYWXaa_1Y$, $FYWXaa_1W$, $FXaa_1YFXaa_2$, $FYYYXaa_1$, $FWXaa_1FF$ and $FFXaa_1WW$ wherein Xaa_1, Xaa_2 and Xaa_3 are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

42. The method of claim 41, wherein the D-peptide comprises pentapeptide core sequence selected from the group consisting of FFFGW, FWFGA, FYGYF, FWAAA, FAYYW, FGYYG, FWAWY, FFWYW, FAAFG, FYWAY, FYWGW, FAYFG, FYYYA, FWGFF and FFAWW.

43. The library of claim 5, wherein each D-peptide is attached to a solid support.

44. The library of claim 31, wherein the solid support is attached to a bead.

45. The library of claim 31, wherein each peptide is attached to a microtiter plate.